the warning was extended over the remaining interior sections. On local indications the official in charge at Galveston displayed northwest storm warnings at 4:30 p. m. At 8 p. m. of the 17th northwest storm warnings were ordered from Morgan City, La., to Brownsville, Tex., with extension of cold-wave warnings to the Texas coast and over southwestern Louisiana; and at 8:40 a. m. of the 18th storm and cold-wave warnings were issued for the remainder of the Louisiana coast. Gales occurred, as predicted, along the entire Texas coast, and there were destructive tornadoes in a few localities in northern Louisiana.

Small-craft warnings were displayed on the Texas coast on the 9th and 23d and were justified. Northeast storm warnings were ordered displayed on the Texas coast at 8:30 p. m. of the 27th, but the increase in wind velocity was gradual and not sufficient on the 28th to justify storm warnings.

Frost warnings were issued on the 20th for the coast sections of Louisiana and Texas, except for the Lower Rio Grande Valley, and on the 25th for northern Louisiana. Towards the close of the month, vegetation was sufficiently advanced in the eastern portion of the district for frost warnings as far north as Little Rock, Ark.

"Norther" warnings for Tampico, Mexico, were issued on the 9th and 18th.—*R. A. Dyke.*

DENVER FORECAST DISTRICT

Low pressures prevailed in Alaska, western Canada, and on the extreme north Pacific coast from the 1st to the 4th, attended by frequent snows in Montana, northwestern Wyoming, and northern Utah, with temperatures much above normal until the 5th. High pressures in the northwestern sections from the 5th to the 8th, together with a moderate depression that remained over the Southwest, were attended by snows from Montana southward to Colorado and by colder weather that had extended on the 8th to southeastern New Mexico. Low pressures continued in the southern portion of the district until the 14th, and a disturbance of marked intensity advanced from the north Pacific coast southeastward across Colorado during the period from the 13th to the 16th. Precipitation resulted in about all portions of the district from the 12th to the 17th, with the heaviest in western Colorado, northern New Mexico, Arizona and Utah. Severely low temperatures east of the Divide in Montana on the 16th, 17th and 18th accompanied the advance of a HIGH from Alberta. A LOW of marked intensity, from Alaska, that extended southeastward across the northern and eastern portions of the district from the 18th to the 23d was attended by snow or rain as far southward as Colorado and northern New Mexico. The last important storm of the month developed over the southern portion of the Rocky Mountain region on the 26th and advanced, with decreasing intensity, to southwestern Texas on the 28th. Precipitation resulted from Montana southward to northern Arizona and northern and eastern New Mexico.

Warning of a moderate cold wave in eastern Colorado, extreme eastern New Mexico, and southern Wyoming was issued on the morning of the 8th. The warning was fully verified. Warning of a moderate cold wave in northeastern Wyoming and east of the divide in Montana, which was also fully verified, was issued on the morning of the 12th. On the morning of the 14th warning was issued of a moderate cold wave east of the divide in Montana, and the warning was extended on the evening of the same day to include Wyoming. Verification was received in eastern Montana, but the warning failed of verification in Wyoming, owing to the development of a LOW over the southern portion of that State. On the morning of the 16th warning was issued of a severe cold wave immediately east of the divide in Montana and in northern Wyoming. The warnings were extended on the evening of the 16th to include all of Wyoming, and moderate cold-wave warnings were issued for eastern and central Colorado. Severe cold-wave warnings were issued on the morning of the 17th for eastern Colorado and moderate cold-wave warnings for that portion of New Mexico east of the mountains. The warnings were verified except in western Wyoming. Warning of a moderate cold wave in extreme western Colorado and southern Utah, issued on the morning of the 28th, was verified in southwestern Colorado and extreme southeastern Utah.

A cold wave without warning occurred in eastern Montana on the 8th, owing to the unexpected strengthening and slow movement of a HIGH over that region. The cold wave, for which warnings were issued on the 28th, extended to southeastern Colorado, for which section warnings had not been prepared.

Warning of heavy snows in southwestern Colorado, northeastern Arizona, and southern Utah was issued on the morning of the 12th, together with livestock warnings for those sections. Heavy snows continued in the region specified until the night of the 16th–17th.

Forecasts of strong winds in eastern Colorado and Wyoming were issued in the interests of aviation on the 1st, 2d, 3d, 15th, 16th, 18th, 19th, 20th, 21st, and 22d. These were generally verified.—*J. M. Sherier.*

SAN FRANCISCO FORECAST DISTRICT

At the beginning of February the pressure over the greater part of the northeast Pacific Ocean was quite low and the subpermanent high-pressure system normally found between California and Hawaii was considerably south of its usual position. Weather conditions over the far western portion of the continent above latitude 35° were much disturbed in consequence; rains were of frequent and general occurrence, and southerly gales prevalent along the north coast. Warnings for the latter, which had been displayed on the Oregon-Washington coast on January 31, were continued almost uninterruptedly, with occasional extensions to cover Puget Sound and the northern California coast, until the 5th, when the pressure rose over the ocean east of the 140th meridian, and several days of comparatively undisturbed weather intervened. Frost warnings, incident to this pressure rise, were issued from the 8th to the 11th, inclusive, for orchard areas in northern California.

Although the barometer was high during the latter period over the far western States and for some distance westward, a change of unusual significance was taking place in the pressure situation over the northeast Pacific Ocean as a whole, which resulted in conditions thereover which were without parallel since the charting of ocean pressures was begun at the San Francisco forecast center, with the possible exception of the period April 1–5, 1926, when a situation similar in type, if not in intensity and length of duration, prevailed. The characteristics peculiar to both these periods were as follows: (1) The development of an oceanic LOW in the south end of a trough overlying the middle Pacific Ocean, (2) the simultaneous development of a LOW over the southwestern United States, and (3) the gradual dissolution of the high-pressure ridge which lay between these two low-pressure sys-

tems extending from the Gulf of Alaska southward to low latitudes off our western coast. So obvious was the trend of conditions to the westward that no hesitation was felt in the issuance of the regular weekly weather outlook on Saturday, February 12, predicting general rains in the far western States with snows in the mountains for the entire week. The day following storm warnings were ordered along the California coast, and warnings were issued to power and transportation interests to prepare for a succession of disturbances accompanied by heavy snows in the Sierra. The situation was so unusual that conservatism was properly abandoned and emergency measures were advocated.

The initial disturbance reached the California coast on February 13 and wet weather prevailed over the greater part of the Pacific Slope from then until the 26th, when the weather cleared and became settled in California, although light rains continued in parts of the North Pacific States. Especially stormy weather prevailed in California from the 13th to the 17th. Warnings were required on some part of the coast during all of this time, and strong winds or gales occurred daily. Exceptionally strong gales occurred during the night of 15th–16th, when a maximum velocity of 76 miles, southeast, was recorded at Point Reyes. The most notable feature, however, of this period was the extraordinary rainfall in southern California, which was unequalled in amount for any similar period since the deluge of January, 1916. Precipitation totals ranged from 5 to 12 inches at a great many observation points, and in some cases even greater amounts were reported. Many bridges were carried away, numerous highways rendered impassable by washouts, and communications variously interrupted. The pressure situation over the adjacent ocean during this time is especially worthy of remark. It was noted above that the Pacific high-pressure system was considerably south of its normal position, with concomitant disturbed weather on the coast north of latitude 35° during the time that this condition prevailed. During the period just mentioned, or more specifically, from the 11th to the 26th, inclusive, this high pressure system was not only far south of its normal position, but for a part of the time, namely, that when the stormiest weather was prevailing in southern California, it disappeared from the area of observation, and there was literally no Pacific HIGH in evidence. The first indication of its reestablishment was on the morning of February 18, and so obvious were the symptoms that special advices were telegraphed to southern California Weather Bureau officials and issued to the press predicting that the period of persistent rainfall was about to terminate, a forecast which was fully verified for the central and southern parts of California, and especially designed to relieve the anxiety which was entertained over a possible continuation of the heavy rains in the extreme southern end of the State, where repairs and rehabilitation were in progress.

The return to higher pressures over the lower latitudes of the ocean was attended by the reappearance of disturbances in the higher latitudes and storm warnings were almost continuously required at north coast ports from the 17th to the 25th, inclusive.—*T. R. Reed.*

RIVERS AND FLOODS

By H. C. FRANKENFIELD

Atlantic drainage.—A period of rain from February 18 to 23 with local heavy falls on February 19 and 23 caused moderate floods in the basins of the James River of Virginia and in the rivers of the Carolinas. The floods were of short duration, the usual warnings were issued, and the damage was little or nothing. Property to the value of $35,000 was reported as having been saved by the warnings. The Santee River of South Carolina was still in flood at the close of the month and did not crest at Ferguson until March 2.

East Gulf drainage.—Heavy rains on February 11–12 over the drainage area of the Alabama River caused a rapid rise in all rivers of that district, that in the upper reaches of the Alabama River being accentuated by the closing of many of the gates at Lock No. 12 and Mitchell Dam on the Coosa River. From 8 a. m., February 13, to 8 a. m., February 14, the rise in the Coosa River at Wetumpka, Ala., was 37.6 feet, and that in the Alabama River at Montgomery, Ala., 23.4 feet. The floods, however, were moderate, and no losses were reported except of a few cattle that had strayed back to the river after having been driven out of the lowlands when warnings were received.

The same general conditions prevailed over the Black Warrior and lower Tombigbee drainage of Alabama, although in much more pronounced form below the mouth of the Black Warrior River. The crest stage at Demopolis, Ala., was 52.5 feet, 13.5 feet above the flood stage, at 5 p. m., February 22, but at Lock No. 10, Tuscaloosa, Ala., the highest stage was 0.3 foot below the flood stage of 46 feet. Impounding of water behind the dam at Lock No. 17, 25 miles above, probably prevented a further rise of 6 or 8 feet at Tuscaloosa, and of a foot or two more at Demopolis. Lowlands for a distance of 175 miles below Demopolis were inundated, but the losses were only about $10,000, as a greater flood had occurred during January and after that flood there was little property subject to damage left in the river bottoms. Property valued at $4,000 was saved by the warnings.

Floods in the Pascagoula and Pearl systems of Mississippi and Louisiana were also moderate as a rule. The weather had been dry for several months; otherwise the amount of rain that fell from February 12 to 14 and on February 18 and 19 would have produced a much greater flood. The Lower Pearl and West Pearl Rivers were still in flood at the close of the month. Loss and damage as reported was $65,900, while the reported value of property saved through the warnings was $40,700. The loss to farmers was negligible.

Ohio drainage.—The January floods in the Wabash and White Rivers of Indiana continued during the early days of February, an ice gorge in the Wabash below Covington, Ind., causing a stage at Covington of 24 feet, or 8 feet above the flood stage, on February 1. There was a slight additional swell caused by the rains of February 5, but nothing more, and no damage was reported except that given in the MONTHLY WEATHER REVIEW for January, 1927.

The Green River of Kentucky was generally in flood from about January 22, and it was not until February 10 that the flood waters subsided over the lower reaches. The crest stages were from 12 to 14 feet above the flood stages, with a maximum at Lock No. 4, Woodbury, Ky. Warnings were widely distributed before and during the high water, and the total of reported losses was small. The American Red Cross contributed effectively to relief work along the middle reaches of Green River.

Heavy rains over the upper Tennessee River drainage on February 22 and 23 caused a decided rise in all upper tributaries and the upper river, with moderate flood stages in several of the former and at Rockwood, Tenn., on the latter. No damage was reported. At the end of